HOW CAN LIFELONG LEARNING SKILLS BE ASSESSED AT UNIVERSITY?

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Abstract

At the University specific competences and skills have been traditionally evaluated, whereas generic skills (such as writing and speaking competences) were used to refine the rating. Promote or encourage and subsequently assess generic skills is a challenge driven by the Bologna plan. The aim of this study was to analyse the efficiency of a methodology designed to encourage self-learning and lifelong learning skills. A compulsory course of Livestock Production and Environment belonging to the Agro-Environmental Engineering Degree with 36 students enrolled was taken for this study. After a presentation and some discussion with the students about the lifelong learning skills in the classroom, some documents specially elaborated for this course on "How to understand and explain tables and figures of scientific data", "Virtual farm management", "Making field works" were made available at the Moodle platform. Different learning activities, both in the classroom and on-line, were carried out based on this material. Afterwards, generic competences and skills were assessed through three questions in the partial exams, and the efficiency and success rates (% of students passing of those registered or presented) and average scores were analysed. In addition, the effect of students' motivation level (3 categories calculated from the % of learning activities performed in the course; 94, 81 or 60%, on average for each category) on the assessment of the activities and questions related to lifelong learning skills was also analysed. The average efficiency and success rates of understanding and explaining scientific data were 52 and 56%, respectively, these values being lower than those obtained for specific skills of the course (80.5 and 93.5%, respectively). However, in the evaluation of the self-learning ability (virtual farm management) and the ability to think about their own learning process, the efficiency and success rates (82 and 87%, respectively) was comparable to those of the specific competences. The group with low motivation level impaired ($P<0.01$) the scores obtained in 3 of 4 activities related to understanding and explaining scientific data, showing scores about 50 to 67% of those of the group with high motivation level. Finally, students completed a survey on their perceptions on how well this course improved their lifelong learning skills. Survey responses indicated that they seemed to be aware of the importance of lifelong learning (84%). Most of them (87%) considered themselves able of preparing a complex topic on livestock production and 71% knew where to find the required information. Their opinion about generic competencies linked to livestock production was very positive, as they believed that the course had increased their ability to observe critically livestock facilities (97%), to visualize the effects of animal production on the environment (94%), and to quantify agro-livestock resources and emissions (90%). However, when the competences were not linked to the course topics the evaluation was lower (61 to 80%).

Keywords: Lifelong learning skills, assessment, generic competences.

1 INTRODUCTION

Specific skills related to courses in engineering Degrees have been traditionally evaluated at the University and generic skills (such as written and oral expression) have being used for refining the scores. Moreover, it has been assumed that generic skills were acquired by the students along with the specific ones during their previous formation. The legislative changes initiated by the Bologna plan focused on students' learning and comprehensive training, promoting an improvement in the skills and attitudes of students and their evaluation. A large number of general skills to be met and assess were defined in the Verification Memories of current Degrees. Likewise, when drawing tutorials on different subjects, many generic skills were usually noted, because they are actually taken into account in some lessons. However, verification criteria of Degrees defined by ANECA show that the generic skills should be trained and objectively assessed in different courses. In this situation, the ETSIA assigned to each course a generic skill, and the course "Livestock Production and Environment" was assigned to address lifelong learning skills. The authors of the present study are teachers of this course and considered that one of the most important skills for students and professionals of Agro-Environmental Engineer is to stay updated in animal production. Therefore they designed learning activities focused on critical analysis of information. It has to be noticed that the topic of animal production is not key in this Degree, but it is very important its interaction with other courses. After designing and implementing a series of activities designed to promote the self and lifelong learning, the aim of this study was to analyze the efficiency of these actions.

2 METHODOLOGY

The study was conducted with a group of 36 Agro-Environmental Engineering Degree students on their third year at the University and taking the “Livestock Production and Environment” course. This course is 4 ECTS and the only one on this topic in the Agro-Environmental Engineering Degree, having therefore a broad content.

2.1 Tasks and learning activities designed to acquire the competences

As stated above, several learning activities were designed to help the students to acquire lifelong learning skills. The first day of school the course was presented and students were given a talk about lifelong learning with a Power Point presentation support (7 slides). The talk was based mainly on the study of Mourtos (2003), which addressed the importance of lifelong learning skills for engineering students. First, students were formulated some questions on how long is the half-life of an engineer technical skills, and how long takes to become obsolete what an engineer learns in his career. Afterwards, procedures for self-learning in an effective way and observable indicators about competences were described and discussed in class.

It is widely recognized that students should be motivated by learning and be able of thinking about their own knowledge and learning style. This idea should be the first step to organize their own learning process that will include the search for different sources of information and the critical analysis of this information (calculate, approximate, measure, quantify, compare, contrast data sources, etc.) that will take them to the evaluation and integration of this new knowledge. An example about how read and understand Tables and Figures of scientific papers and technical reports was upload in the Moodle platform at the beginning of the course. Afterwards, two group exercises were performed in the classroom, which were evaluated with a specific question in the first partial exam. Before doing a field visit to the livestock facilities of our Department, a document with the most important aspects on the animal facilities and environment to be observed and analyzed during the visit was uploaded in the Moodle platform. After the visit, the students (in groups of 4-5) had to write a technical report on one of the animal houses.

In addition, each student had to manage a virtual dairy farm for at least 100 virtual days. A training period with a “trial farm” was allowed to all students and some tutorials (video and reports) for computers and dairy management were available on-line. Both the learning of specific concepts and an estimation of self-learning (based on the farm economic and feeding improvements obtained by the students) were evaluated with this activity. In the midterm exam they had to define and explain the three learning results considered most important from their virtual farm management. These results are below shown as “thinking about their own learning process”.

Finally, the students completed a survey at the end of the course. Questions on their perception about the need and ability of lifelong learning skills and how the course had increased their self-learning capacities were formulated and responded by the students by choosing one of three options: agree, no sure or disagree. A similar survey (with some adaptations) was completed by students taking “Production of Foods of Animal Origin”, a course of Food Engineering Degree.

2.2 Data analysis

Efficiency and success rates (defined as % of students passing the course/enrolled students and % of students passing/ students doing the exams, respectively) and average scores of the learning activities and a questions’ test related to the lifelong learning skills were analysed. As motivation is the first step of the learning process, students’ motivation level was estimated as the ratio between the number of activities performed and the number of activities proposed (a total of 25). The students were classified in three categories according to this ratio: high, medium and low motivation level, with an average percentage of activities performed of 94, 81 and 60% for each category, respectively. The effect of motivation level on students’ scores was assessed by analysis of variance using the GLM Procedure of the statistical package SAS (SAS, 2012).

3 RESULTS

The course "Livestock Production and Environment" belongs to the Agro-Environmental Engineering Degree of the School of Agriculture at the Polytechnic University of Madrid. This is a new Degree initiated in the 2012-13 academic year. The number of students repeating the course in 2013-14 was relatively low (8%) and most of the students were in their third University year. Global efficiency and success rates at the end of the term (June exams) had been relatively high (80.5 and 93.5%, respectively).

3.1 Efficiency and success rates

After analysing the results obtained in the academic year 2012-13 and taken into account students' comments, it was decided to give more importance to understanding and application of knowledge than to lecturing. For that purpose new learning activities (exercises, group tasks, resolving problems,..) were planned. Theoretical concepts should be learned by the students outside the classroom with the support of presentations and self-assessement tests available at the Moodle platform. So that, an "inverse teaching method" was implemented (Bergmann and Sams, 2012). The results obtained during the first weeks of the term were satisfactory, but they were getting worse as the term progressed because many students did not work out of school and consequently they were not able to perform the activities in the classroom. Figure 1 shows the evolution of the number of students performing the classroom (in-site) and on-line learning activities during the term period.

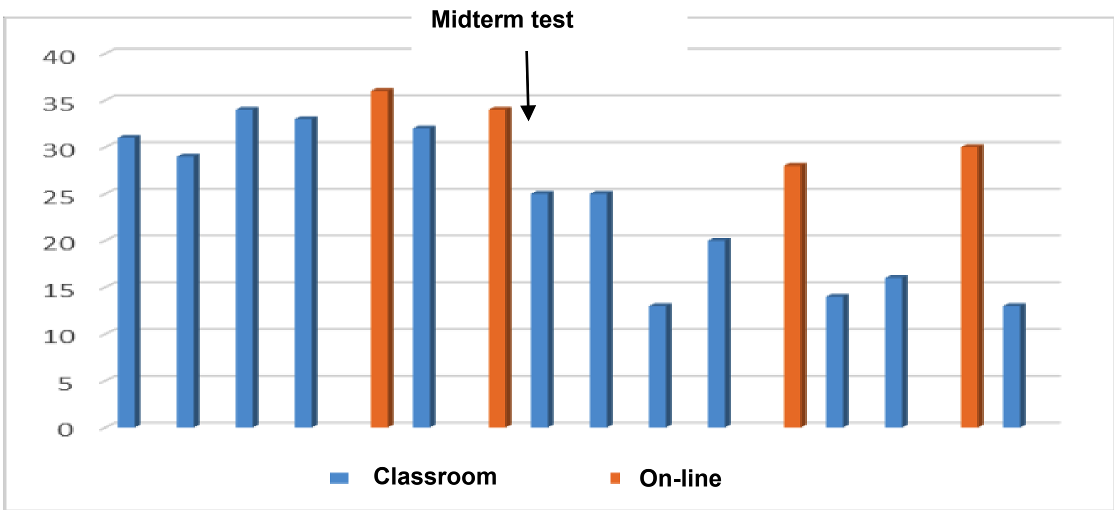

Figure 1. Time evolution of the number of students performing classroom (in-site) and on-line activities during the term

The only activity done by all enrolled students was the first on-line assignment which was performed in groups. As average, the activities programmed for the period previous to the midterm test were completed by 90% of the students, but this rate dropped markedly thereafter, with mean values of 50 and 80% for classroom and on-line activities, respectively. Only 58% of the enrolled students got a grade above the level required to pass the midterm test of the course, and many students stop attending the lectures and performing classroom activities even though students work had to be monitored and assessed of continuously until the end of the course.

As shown in Figure 2, similar results were observed for self-assessment tests. On average, 97 and 78% of the students completed the tests before and after the midterm test, respectively. The average number of attempts to complete the tests made by each student was 3, although there were differences among tests and those on more complex and difficult topics had a greater number of attempts.

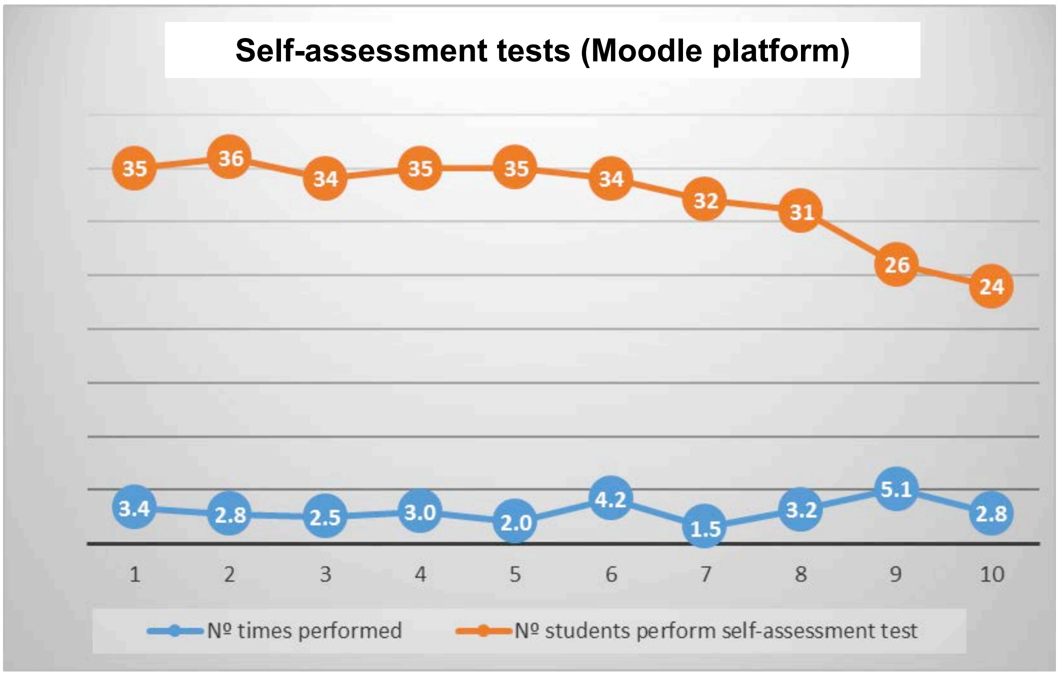

Figure 2. Evolution of the number of students completing the self-evaluation tests and mean number of attempts of completing a test made by each student

3.2 Competencies assessment

Data on efficiency and success rates in interpreting and analysing scientific data and information by the students are shown in Table 1. The activities related with the interpretation and analysis of scientific data had rates of efficiency and success that ranged from 50.0 to 73.5%. Lower values (30-35%) were observed for the ability of interpreting the statistical analysis results. These results indicate that 65-70% of the students were not able to use the statistical analyses as a part of the scientific method. Whereas in the classroom activities most of the students gave the correct response to statistical questions, they did not use the statistical information given in scientific papers or reports to draw conclusions on reported data.

Table 1. Efficiency and success rate and average scores obtained in several activities performed during the course "Livestock Production and Environment"

	Number of students	Efficiency rate (%)	Success rate (%)	Average score (0-10)
Interpretation and analysis of scientific data and information				
Classroom activities	35	58.3	60.0	5.51
Mid-term test	34	69.4	73.5	5.67
Final term test	31	50.0	58.1	5.74
Interpretation of statistical analysis	31	30.6	35.4	3.55
Autonomy and reflection on learning process				
Guided work	34	88.4	94.1	8.78
Reflection on self-learning process	34	75.0	79.4	6.91

High efficiency and success rates were observed in both guided work and reflection on self-learning process, with values ranging from 75.0 to 94.1%. The high success rates obtained in the guided work (management of a virtual farm) were probably due to the immediate feedback received to any action, so that the students quickly learnt to avoid the same mistake. However, some actions that did not received an immediate feedback (such as reducing costs, improving cows' feeding, etc.) were only carried out by 65% of the students. These last actions can be classified as self-guided work rather than as guided work. Similarly, almost 80% of the students were able to describe some learning results from this activity, but only 40% were able to argue clearly their learning.

Table 2 shows the influence of students' motivation levels on the assessment of the activities related to the lifelong learning skills mentioned previously. Motivation had a clear effect on 3 of the 4 activities performed in relation to the interpretation and analysis of data. In both the classroom activities and the ability of interpreting statistical analyses, the group with the highest motivation level had greater scores (7.20 and 8.33, respectively) than the other two groups, which showed no differences between them (5.25 and 0.83 *vs*. 4.05 and 0.00). There were also differences between groups in the scores of the final term test, with the high-motivated group having the highest score (7.33) and the low-motivated group having the lowest one (3.43). In contrast, motivation level did not affect the results of guided work (P=0.608) and reflection on self-learning process (P=0.296).

Table 2. Influence of students' motivation level (estimated as % of participation in learning activities) on averaged scores obtained in several activities several activities performed during the course "Livestock Production and Environment"[1]

	Students' motivation level			Standard error	P-value
	94%	**81%**	**59%**		
Interpretation and analysis of scientific data and information					
Classroom activities	7.20^{a} (12)	5.25^{b} (11)	4.05^{b} (12)	0.47	0.001
First partial exam	6.67 (12)	5.73 (11)	4.55 (11)	0.70	0.13
Second partial exam	7.33^{a} (12)	5.50^{a} (12)	3.43^{b} (7)	0.61	0.002
Interpretation of statistical analysis	8.33^{a} (12)	0.83^{b} (11)	0.00^{b} (11)	0.87	0.001
Autonomy and reflection on learning process					
Guided work	9.06 (12)	8.47 (11)	8.89 (11)	0.42	0.608
Reflection on self-learning process	7.75 (12)	6.45 (11)	6.45 (11)	0.65	0.296

$^{a,\,b}$ values not sharing a common superscripts differ (P<0.05)

[1] Values in brackets are the number of students completing the activities

3.3 Self and life-long learning survey

Figure 3 shows the results of the survey completed by the students at the end of the course. Students seem to be aware of the importance of lifelong learning. About 84% of the students recognized the need of lifelong learning to stay current during professional life in any topic (only one student disagreed) and 74% were against not consulting technical books in the future. When the questions focused on the scope of "Livestock production and Environment" course, 74% of the students agreed that they should continue learning during their practice. The 55% of the students thought that they had adequate knowledge on animal production to practice their profession and the rest of them were not sure on this point. The majority of the students (87%) considered that they were able to address a complex issue on livestock production, 71% knew where to find information (29% were not sure) and 69% thought that this course had improved their ability to find information sources.

In general, students' evaluation of generic competences related to this course was very good, as they thought that the course improved their ability to observe critically livestock facilities (97%), to assess the effects of animal production on the environment (94%) and to quantify and dimension farms resources and emissions (90%). However, the evaluation of competences not related to the scope of the course was lower (61 to 80%). For example, 61% of the students agreed that this course improved their ability to interpret tables and figures in scientific papers and technical reports and only 6.5% disagreed. Similar results were obtained in the questions related to the ability to debate with solid arguments (61% agreed), although higher values were recorded for other abilities such as critically reading and evaluating available information (80% agreed) or processing information from different sources (77% agreed).

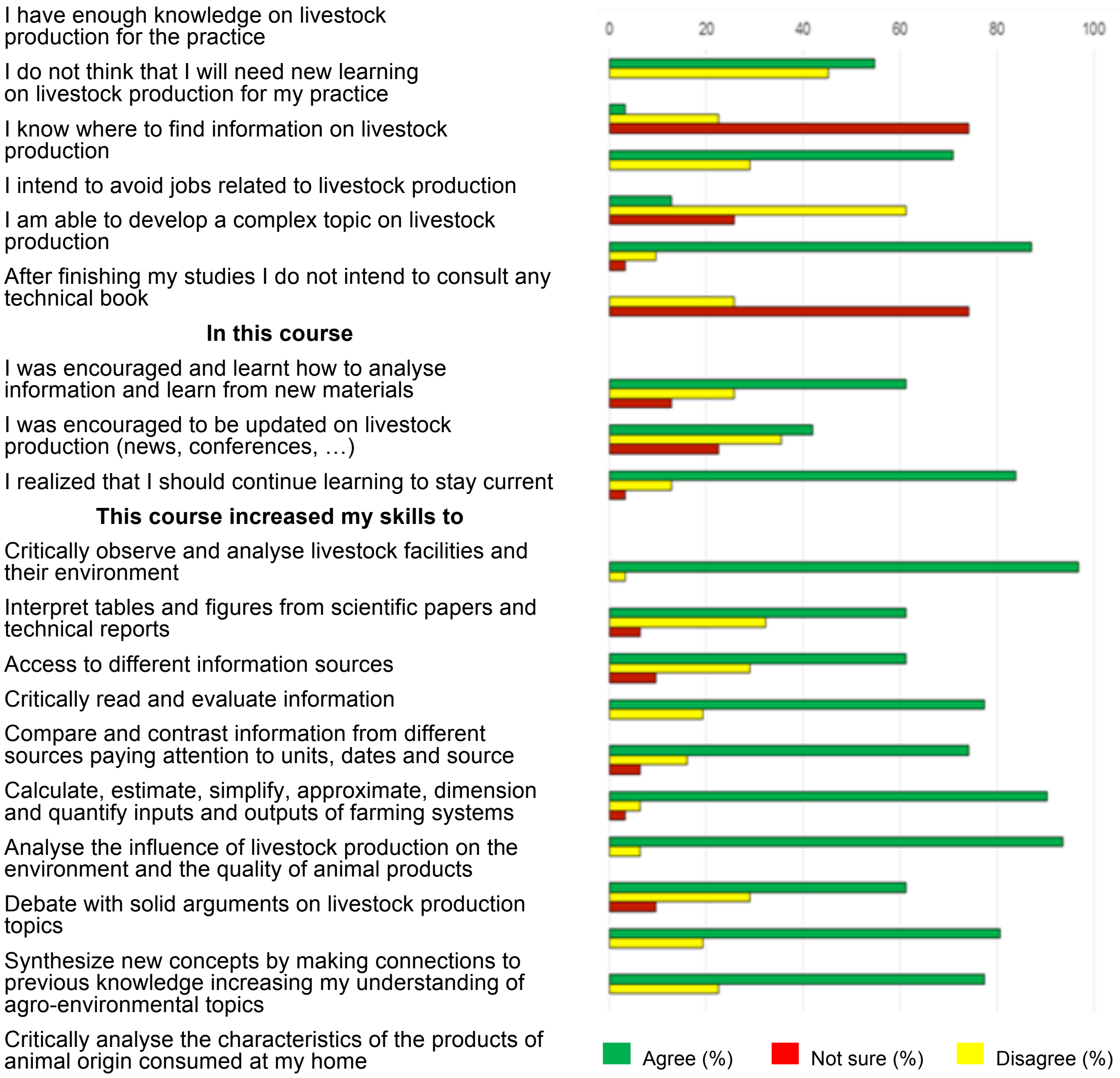

Figure 3. Results of surveys from 31 students of “Livestock Production and Environment” course indicating students’ opinion on the need of lifelong learning and how well this course improved their lifelong self-learning skills

The survey was also completed by a group of students taking “Production of Foods of Animal Origin”, a course of Food Engineering Degree. This course has similar characteristics to those of “Livestock Production and Environment”, as it is in the 3rd year, has 4 ECTS and is the only subject on livestock production in this Degree. Results were analysed by assigning 1 to each “agree” answer, 2 to “not sure”, and 3 to “disagree”. Mean values for the students of “Livestock Production and Environment” and “Production of Foods of Animal Origin” courses were 1.33 and 1.44, respectively. The students taking “Livestock Production and Environment” course expressed higher ability (lower values) to “critically read and evaluate available information” (1.20 vs. 1.61; $P<0.001$), “critically observe and analyse livestock facilities and its environment” (1.03 vs. 1.28; $P< 0.05$) and “analyse the influence of animal production on the environment and the quality of animal products” (1.08 vs. 1.11; $P<0.10$).

4 CONCLUSIONS

The results of this study shows that the learning activities designed for the “Livestock Production and Environment” course were positively evaluated by the students and contributed to make them aware of the importance and need of life-long learning. In addition, most students recognized that this course help them to acquire the skills necessary to continue their self-learning in the future. Finally, the students’ motivation level has a relevant influence on the learning process and on the generic competences.

REFERENCES

[1] Bergmann J. and Sams A. 2012. Flip Your Classroom: Reach Every Student in Every Class Every Day. Ed. International Society for Technology in Education. 112 pp.

[2] Mourtos, N.J. 2003. "Defining, teaching and assessing engineering design skills”. Proc. Of the 33rd ASEE/IEEE Frontiers in Education Conference. November, 2003. Boulder, CO, USA.

[3] SAS. 2012. SAS Institute Inc. SAS/STAT 12.1 User’s Guide. Cary, NC: SAS Institute Inc.